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Bibliographie

Amorphous Polymers and Non-Newtonian Fluids, Edited by Constantine Dafermos, Jerry L. Ericksen and David Kinderlehrer (The IMA Volumes in Mathematics and its Applications, Volume 6), XII+195 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo, 1987.

This, and the preceding IMA Volumes 2 and 4 are in part proceedings of a series of IMA workshops held during 1984—85 on Continuum Physics and Partial Differential Equations. The book includes 10 separate papers, clustered mainly around concepts, models and mathematical problems in the theory of viscoelastic flow of polymers. There is a brief introduction to the kinetic theory of polymeric liquids in order to show the kinds of differential equations that arise for the configuration-space distribution functions. The aim of the second paper is to study Lagrangian concepts which can be of use in the finite element simulation of viscoelastic flows. The main result of the paper on Solutions with Shocks for Conservation Laws is contained in a proposition, which states that when the "memory" response is appropriately dissipative then the total variation of the solution is bounded independently of the variation of the initial data. The initial value problem of the motion of linear and nonlinear viscoelastic materials are discussed with special emphasis on the development and smoothing of singularities.

This monograph level book is of interest to mathematicians and physicists interested in the continuum physics and the applications of partial differential equations.

I. K. Gyémánt (Szeged)

Automata, Languages and Programming (Proceedings, Karlsruhe, 1987). Edited by T. Ottmann (Lecture Notes in Computer Science, 267), X+565 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1987.

This book contains the presentations of the 14th International Colloquium on Automata, Languages and Programming (ICALP 87) held at the University of Karlsruhe, from July 13 to July 17, 1987.

ICALP 87 is a broadly based conference covering all aspects of Theoretical Computer Science including topics like Algorithms and Data Structures, Automata and Formal Languages, Computability and Complexity Theory, Semantics of Programming Languages, Program Specification, Transformation and Verification, Theory of Data Bases, Logic Programming, Theory of Logical Design and Layout, Parallel and Distributed Computation, Theory of Concurrency, Symbolic and Algebraic Computation, Term Rewriting Systems, Cryptography and Theory of Robotics.

These proceedings consist of three invited papers and 46 contributed ones. The list of invited addresses is: J. Karhumäki: On Recent Trends in Formal Language Theory; J. T. Schwartz and

M. Sharir: On the Bivariate Function Minimization Problem and its Applications to Motion Planning; L. G. Valiant: Recent Developments in the Theory of Learning.

This well edited volume presents the state of art in Theoretical Computer Science. It is recommended for everybody interested in the latest results of the field.

S. Vágvölgyi (Szeged)

E. Behrends, Maß und Integrations theory (Hochschultext), VII+260 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

The text is divided into five chapters. Chapter 1 is concerned with the basic concepts of measure and integral theory. The theorem on measure extension is proved and at the end of the chapter the integral is defined. Chapter 2 deals with the fundamental theorems of measure and integral theory. The convergence theorems, the Radon—Nikodym theorem are proved. Also the product of measures, the Fubini theorem, and the Hahn and Jordan decompositions are given. Chapter 3 introduces the Lebesgue—Stieltjes measures in R^n and characterizes the functions which are integrable in Riemannian sense. Chapter 4 is devoted to the description of the L^p spaces and their dual spaces. The final Chapter 5 deals with measures in topological spaces, contains the Riesz representation theorem and characterizes the dual space of the space of continuous functions defined on a compact space. Two short Appendices are concerned with the analytic sets and with the projections of Borel sets.

László Gehér (Szeged)

B. Benninghofen—S. Kemmerich—M. M. Richter, Systems of Reductions (Lecture Notes in Computer Science, 277), VII+265 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1987.

Recently there has been considerable interest in rewriting systems because of their applications to theorem proving, specifications of abstract datatypes, algebraic simplification, etc.

Most of the results in these notes were obtained in the years after 1978 at the Technical University of Aachen. The last part of this book was written by F. Otto, the material is a part of his Habilitationsschrift at the University of Kaiserslautern.

"There are two main lines of research here. On the one hand one studies the completion algorithm and searches for criteria which ensure its termination. As the completion algorithm in many (one is tempted to say 'most') cases fails to terminate this leads to the investigation of infinite systems. In many cases these can be finitely described and are as useful as finite systems.

The other type of investigations is concerned with the use of complete systems. A complete system certainly provides an answer to the word problem but unravels much more of the structure of the algebra under investigation. This turns out to be most apparent in the case of groups."

Titles of the chapters describe well the topics involved: I. General Concepts from Universal Algebra; II. Finite Sets of Reductions; III. Infinite Sets of Reductions; IV. Automata and Reductions; V. Deciding Algebraic Properties of Finitely Presented Monoids.

This nice book may be recommended to everybody interested in rewriting systems.

S. Vágvölgyi (Szeged)

János Bolyai, Appendix, The Theory of Space, 239 pages, Akadémiai Kiadó, 1987.

The bimillennial hope to deduce Euclid's Fifth Postulate from the remaining part of his foundations vanished ultimately when, in the twenties of the last century, J. Bolyai, Lobachevsky, and

Gauss simultaneously and independently "have created another world, a new world of nothing": the world of non-Euclidean geometries, the Fifth Postulate is not valid in.

The words between quotation marks are taken from a letter written by János Bolyai, a 21 year old Hungarian military engineer. The youngest of the great trinity, who started to elaborate his new geometry in 1823, and, although he lived further 37 years, his fate is commensurable with that of Évariste Galois. Really, during his life, his discovery received no appreciation, and he died with the dreadful sense of complete indifference and incomprehension from the side of his native country and of scientific community.

This book is a facsimile edition of J. Bolyai's pioneering work, which appeared as an appendix to his father's mathematical textbook in 1832. It contains also the English translation of the Latin original, and, in a compact and well-readable form, the most important information on the history of Euclid's Fifth Postulate including summaries on the related results of Gauss and Lobachevsky, as well as concise comments on each paragraph of the Appendix. Furthermore, the book comprises a part on how J. Bolyai's work is reflected by subsequent research and how large influence it had on the evolution of mathematics in our century. These additional chapters are written by Prof. F. Kárteszi.

Finally, the reader can also appreciate a supplement due to Prof. B. Szénássy, painting a colorful historical and biographical background to this wonderful scientific breakthrough.

The book is recommended to everybody interested in geometry or history of mathematics. It can also serve as a base for a university course on the foundations of geometry.

Rozália Juhász (Szeged)

I. Borg—J. Lingoes, Multidimensional Similarity Structure Analysis, XIV+390 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo, 1987.

Multidimensional similarity structure analysis (SSA) comprises a class of models that represent the similarity among entities (for example, variables, items, objects, persons, etc.) in multidimensional space to permit one to more easily grasp the interrelations and patterns present in one's data.

The book is divided into the following chapters: Construction of SSA Representations; Ordinal SSA by Iterative Optimization; Monotone Regression; SSA Models, Measures of Fit, and Their Optimization; Three Applications of SSA; SSA and Facet Theory; Degenerate Solutions in Ordinal SSA; Computer Simulation Studies on SSA Multidimensional Unfolding; Generalized and Metric Unfolding; Generalized SSA Procedures; Confirmatory SSA (1); Confirmatory SSA (2); Psysical and Psychological Spaces; SSA as Multidimensional Scaling; Scalar Products; Matrix Algebra for SSA; Mappings of Data in Distances; Procrustes Procedures; Individual Differences Models.

"The book is oriented to both researchers who have little or no previous exposure to data scaling and have no more than a high school background in mathematics and to investigators who would like to extend their analyses in the direction of hypothesis and theory testing or to more intimately understand these analytic procedures. The book is replete with examples and illustrations of the various techniques drawn largely, but not restrictively, from the social sciences, with a heavy emphases on the concrete, geometric, or spatial aspect of the data representations."

J. Csirik (Szeged)

N. Bourbaki, Topological Vector Spaces (Chapters 1—5), VII+364 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

This is the English translation of the original French edition. In the first chapter the notion of topological vector spaces over a valued division ring is introduced, linear varieties and subspaces are defined and properties of metrisable topological vector spaces are given. In Chapter 2 locally convex spaces are considered over the field of real numbers. Here the Hahn—Banach theorem in algebraic and geometric forms can be found, the dual space and weak topologies are introduced and the Krein—Milman theorem is proved. The last paragraph of this chapter deals with topological vector spaces over the field of complex numbers. Chapter 3 introduces the notion of bornology in topological vector-spaces, investigates the spaces of continuous linear mappings. The Banach—Steinhaus theorem and Borel graph theorem are also proved. Chapter 4 is devoted to the study of the duality in topological vector spaces, to the topologies compatible with duality, and the bidual and reflexive spaces and gives compactness criteria. In an appendix fixed points of groups of affine transformations are considered. Chapter 5 contains the elementary theory of Hilbert spaces and some classes of operators in Hilbert spaces. At the end of all chapters a rich collection of exercises can be found.

László Gehér (Szeged)

Nigel P. Chapman, LR Parsing, Theory and Practice, VIII+228 pages, Cambridge University Press, Cambridge—New York—New Rochelle—Melbourne—Sydney, 1987.

Linear time deterministic parsing methods have been widely used in syntax analysis. *LR* parsing, initiated by D. E. Knuth in the mid 60's, seems to be appropriate for most practical problems. This volume successfully brings together the theory and practice of *LR* parsing with emphasis on parser construction and implementation.

The book consists of ten chapters, the first one is providing an introduction with historical notes. Chapter 2 contains the necessary elements of formal languages and automata, including right linear grammars and finite state machines, as well as context free languages and pushdown automata. Chapter 3 is a good introduction to $LR(0)$ and $SLR(1)$ parsing. Chapter 4 starts with a parser oriented definition of $LR(k)$ grammars and provides necessary and sufficient conditions on a grammar to be $LR(k)$ for a given integer k. After discussing the canonical $LR(k)$ parser construction, it culminates in a brief discussion on the relation of $LR(k)$ languages to deterministic context free languages, the complexity of $LR(k)$ parsing, as well as the inefficiency of the canonical $LR(k)$ parser construction. This motivates the need for defining $LALR(k)$ grammars in Chapter 5, an intermediate class between $SLR(k)$ grammars and $LR(k)$ grammars. After a brief account of some aspects of the definition, the second part of Chapter 5 deals with practical *LALR* parser constructions and a general method for *LR* parser construction.

Chapters 6 to 10 are concerned with more or less practical matters, such as data structures, optimization of parser tables, the relation of *LR* parsers to other system components, semantic actions during *LR* parsing, error handling, some extensions of the *LR* technique, and automatic generation of *LR* parsers. Algorithms for computing the reflexive transitive closure of a relation are exploited in the Appendix.

The Bibliography contains more than 100 items relevant to *LR* parsing and gives a good source for further reading. A carefully compiled Index helps guide the reader in looking up notions and notations.

The book is written in a nice style. Numerous examples are worked out. It can be recommended to graduate students and computer scientists with interest in formal languages and/or compiler techniques.

Z. Ésik (Szeged)

Aleksei A. Dezin, Partial Differential Equations (An Introduction to a General Theory of Linear Boundary Value Problems), XII+163 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

One often hears that generalization by abstraction in analysis "does nothing really new and finds no new results". Although there is a valid basis behind this opinion, we can find such generalizations which contain originally new things. As an example we recommend this book.

It is well known that mathematical physics, the study of boundary value problems of partial differential equations is the source of some new notions of analysis. Usually the authors in this branch of mathematics investigate restricted classes of equations. In the wide range of applications new and new problems arise which do not belong to the known types. These suggest the necessity of the more general way of putting the question. Briefly summarizing, this book studies the dependence of the solvability of given linear partial differential equations from the choice of the boundary conditions by using the methods of functional analysis especially the theory of linear operators in Hilbert space. The first two chapters give a concise, clear summary of the main notions and theorems of functional analysis which are necessary in the further study. This was a hard, master's work. The most important part of the book is Chapter 4—6 titled Model Operators; First-Order Operator Equations; Operator Equations in Higher Order. The investigated problems are of fundamental importance and the results are remarkable. The discussion is carried out with elegance and it is a striking example of the interplay between partial differential equations and functional analysis. In order to put the case more clearly several remarks — introductory and concluded ones at the beginning and at the end of some chapters, respectively — make the difficulties, the importance of the theorems clear and constitute a very good reference source for further study.

Nothing can prove better the success of the method applied in this book than the Appendix 2, in which the translater R. P. Boas sums up some results having been achieved in this theme since the first publication of this book in Russian. For experienced reader R. P. Boas' name can be a guarantee as well that this is a good book, otherwise it is not likely that he would have undertaken the translation.

Lajos Pintér (Szeged)

Differential Geometry, Proceedings, Lingby, 1985. Edited by V. L. Hansen (Lecture Notes in Mathematics, 1263), X+288 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

This volume contains the lectures held at the Nordic Summer School that took place at the Technical University of Denmark in Lingby: P. Braam, Quantum field theory: the bridge between the mathematics and the physical world; J. P. Bourguignon, Yang—Mills theory: the differential geometric side; F. Burstall, Twistor methods for harmonic maps; J. Rawnsley, Twistor methods; J. L. Kazdan, Partial differential equations in differential geometry; K. Grove, Metric differential geometry; R. Greene, Complex differential geometry. "The main reason for choosing differential geometry as the subject for the 1985 Nordic Summer School in mathematics was that the last two decades have witnessed a new strong interaction between mathematics and field theories in physics" — the editor writes in the Preface. The lectures have introductory character and present important mathematical tools and results necessary for making research into the applications of differential geometry in physics.

Péter T. Nagy (Szeged)

Differential Geometry and Differential Equations, Proceedings, Shanghai, China, 1985. Edited by Gu Chaohao, M. Berger and R. L. Bryant (Lecture Notes in Mathematics, 1255), XII+243 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

The Sixth Symposium on Differential Geometry and Differential Equations was held from June 21 to July 6, 1985 in Fudan University, Shanghai, China. This volume contains the proceedings of this conference. The topics cover a wide range of differential geometry: global submanifold theory of Riemannian manifolds, extremal surfaces in Minkowski spaces, the imbedding problems of symmetric spaces, the geometric theory of harmonic maps, Lie transformation groups, gauge theory, spectral geometry, etc.

The book gives a good overview of some important fields of differential geometry and makes us acquainted with the scientific activity of high level in this traditional subject in China.

Péter T. Nagy (Szeged)

Z. Ditzian—V. Totik, Moduli of Smoothness (Springer Series in Computational Mathematics, 9), IX+225 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo, 1987.

The subject of this book is the introduction and application of a very useful new type of moduli of smoothness of functions. As the theorems included in the book prove this new measure of smoothness gives a better tool to deal with the rate of best approximation, inverse theorems and imbedding theorems. The fundamental feature of this new modulus is the replacement of h in $\omega^r(f;t)=\sup_{0<h\leq t}\|\Delta_h^r f\|$ by $h\cdot\varphi(x)$ to obtain $\omega_\varphi^r(f;t)_p=\sup_{0<h<t}\|\Delta_{\varphi h}f\|_{L^p}$ where the choice of $\varphi(x)$ is depending on the problem that has to be solved.

Here we pick up just three advantages of this new modulus. The first one is that it can easily be used to characterize the particular class of functions for which more smoothness is required inside the interval than near its endpoints (see especially the cases of weighted polynomial approximation in L_p). The new modulus furthermore is suitable to solve some basic problems in approximation theory related to the characterization of the class of functions defined by the rate of approximation by known operators (for example by the Kantorovich operators). The third fact that should be noted is that this new modulus plays very important role in the theory of interpolation spaces (for example in the problem of characterization of K-functionals introduced by J. Peetre for investigation of interpolation spaces between two Banach spaces). The book is divided into two parts and thirteen chapters. In Part I the following investigations are included: equivalence relation of the new modulus with the K-functional; the introduction of the main-part modulus and its relation to ω_φ^r; the extension of all important properties of the classical modulus to the new one; weighted moduli of smoothness. Part II contains the applications for the best polynomial approximation on $[-1,1]$; for the rate of convergence of various operators; for the best weighted polynomial approximation on R; for the best polynomial approximation on simple polytopes.

The book is well organized, its style is clear. The results are new and complete proofs are given. Certainly this book will be very useful for researchers interested in approximation theory.

József Németh (Szeged)

Functional Analysis II (with contribution by J. Hoffmann—Jørgensen et al.), Edited by S. Kurepa, H. Kraljević and D. Butković (Lecture Notes in Mathematics, 1242), VII+432 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Tokyo, 1987.

This volume contains seven papers. Four of them, essentially lecture notes, are as follows: A. Dijksma, H. Langer and H. de Snoo, Unitary colligations in Krein spaces and their role in the extension theory of isometries and symmetric linear relations in Hilbert spaces; S. Kurepa, Quadratic and sesquilinear forms. Contributions to characterizations of inner product spaces; J. Hoffmann—Jørgensen, The general marginal problem; Z. R. Pop—Stojanović, Energy in Markov processes.

The corresponding four series of lectures were given at postgraduate school and conference on Functional Analysis held from November 3 to November 17, 1985 at the Inter-University Center of Postgraduate Studies, Dubrovnik, Yugoslavia.

The remaining three papers, namely: S. Suljagić, Invariant subspaces of shifts in quaternionic Hilbert space; D. Butković, H. Kraljević and N. Sarapa, On the almost convergence; N. Elezović, p-nuclear operators and cylindrical measures on tensor products of Banach spaces; are connected with one-hour lectures presented at the same school and conference.

As the titles of the papers already show, this collection deals with several branches of functional analysis, operator theory and their applications. Beside its expository content it contains also some new results with proofs.

The volume can be useful for postgraduate students, and first of all for researchers interested in one or more topics discussed in it.

E. Durszt (Szeged)

Johan Grasman, Asymptotic Methods for Relaxation Oscillations and Applications (Applied Mathematical Sciences, 63), XIV+221 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo, 1987.

Relaxation oscillations are present in various fields of chemistry and biology. In a typical relaxation oscillation some of the variables may vary rapidly during a short time interval and the others fluctuate regularly. The differential equation models contain a "small parameter". The solution of the reduced system (the system with $\varepsilon=0$) gives the regular approximation, which gives a good impression of the qualitative behaviour of the solution apart from the rapid variation during the short time interval. For the purpose of making a quantitative approximation, expansions with respect to the small parameter are necessary. In this book the author shows that the method of matched asymptotic expansions makes it possible to describe quantitatively phenomena such as chaotic dynamics of physical and biological systems.

In the Introduction examples for phenomena of relaxation oscillation are presented. In Section 2 the definition of a relaxation oscillation and a review of the proofs of existence of periodic solutions of singularly perturbed systems are given, and an asymptotic analysis of the Van der Pol oscillator and of the Volterra—Lotka equations are made. A chaotic relaxation oscillator is constructed, as well. In Section 3 a rigorous theory for the existence of entrained solutions for systems of coupled relaxation oscillators, and interpretation of entrainment phenomena in biological systems are given. In Section 4 asymptotic approximations are constructed for the Van der Pol oscillator with sinusoidal forcing term, and equivalence between solutions and iterates of an interval mapping is established.

Appendices and appropriate references to most recent results complete this book, which is warmly recommended to mathematicians, physicists and biologists interested in applications of the theory of dynamical systems.

I. K. Gyémánt (Szeged)

Hydrodynamic Behavior and Interacting Particle Systems, Edited by George Papanicolaou (The IMA Volumes in Mathematics and Its Applications, Volume 9), VI+215 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo, 1987.

This is the third IMA volume (out of four) with papers presented at a workshop on Stochastic Equations and Their Applications. The workshop was held in 1986 at the Institute for Mathematics and Its Applications at the University of Minnesota. Research of several different directions are contained in these papers. The table of contents: 1. R. E. Caflisch: Stochastic Modelling of a Dilute Fluid-Particle Suspension. 2. P. M. Chaikin, W. D. Dozier and H. M. Lindsay: Experiments on Suspensions of Interacting Particles in Fluids. 3. D. A. Dawson: Stochastic Models of Parallel Systems for Global Optimization. 4. R. Figari, G. Papanicolaou and J. Rubinstein: Remarks on the Point Interaction Approximation. 5. K. F. Freed, S. Wang and J. F. Douglas: Renormalization Group Treatment of the Hydrodynamics of Polymer Chains in the Rigid Body Approximation. 6. J. Fritz: On the Hydrodynamic Limit of a Scalar Ginzburg—Landau Lattice Model: The Resolvent Approach. 7. J. Goodman: Convergence of the Random Vortex Method. 8. L. G. Gorostiza: Supercritical Branching Random Fields. Asymptotics of a Process Involving the Past. 9. D. E. Loper and P. H. Roberts: A Simple Mathematical Model of a Slurry. 10. H. Osada: Limit Points of Empirical Distributions of Vorticies with Small Viscosity. 11. S. Ozawa: Mathematical Study of Spectra in Random Media. 12. J. Rubinstein: Hydrodynamic Screening in Random Media. 13. H. Spohn: Interacting Brownian Particles: A Study of Dyson's Model. 14. A. S. Sznitman: A Propagation of Chaos Result for Burgers' Equation. 15. H. Tanaka: Limit Distributions for One-Dimensional Diffusion Processes in Self-Similar Random Environments.

Introduction to modern mathematical methods is contained in papers 6 and 13. Analytical methods currenty used in the physics and chemistry literature are presented in paper 5. The continuum limit of boundary value problems in regions with small inclusions is analyzed in 4, 11 and 12. In papers 3, 8 and 15 the probabilistic aspects of particle systems on random media are discussed. The vortex method is treated in 7 and 10.

This monograph level book is of interest to researchers in applied mathematics, engineering, and physics.

I. K. Gyémánt (Szeged)

I. M. James, Topological and Uniform spaces (Undergraduate Texts in Mathematics), IX+163 pages, Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo, 1987.

The book is divided into 13 chapters. The text starts with a preliminary chapter dealing with certain aspects of the theory of sets. The first two chapters are concerned with some basic axioms, with continuity and with topological product. Also the topological groups are introduced. Subspaces and quotient spaces are considered in Chapter 3. Chapter 4 deals with functions which are structure preserving in the direct image sense. Specifically open and closed functions are considered. In Chapter 5 the notion of compactness is introduced and the characterization of compact spaces in terms of filters is given. Chapter 6 is concerned with the separation axioms and the basic properties of Hausdorff regular and normal spaces are established. Chapter 7 and 8 contain the definition of the uniform spaces with illustrations taken from topological groups and metric spaces,

and introduce the uniform continuity of functions and discuss the Cauchy condition both for sequences and for filters. Chapter 10 deals with the two countability axioms. Also σ-compactness, sequential compactness, Lindelöf property and separability are considered. Chapter 11 returns to the separation axioms, furthermore introduces the complete regularity and shows that this property is necessary and sufficient for a topological space to be uniformisable. At the end of this chapter the Urysohn theorem is proved. The last chapter is concerned with completeness and completion of metric and uniform spaces.

László Gehér (Szeged)

J. Lindenstrauss—V. D. Millman, Geometrical Aspects of Functional Analysis (Lecture Notes in Mathematics, 1267), 212 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

The book contains 16 papers the material of which are based on lectures held in the Israel Seminar on Geometrical Aspects of Functional Analysis between October 1985 and June 1986. Most of the papers are based on original research which have not been published elsewhere, the others are of expository nature. The basic topics are: imbedding problems, extension of Lipschitz maps and the study of convex sets in R^n and Banach spaces, which play a central role in the subject.

The book is highly recommended to researchers interested in the Banach space theory.

László Gehér (Szeged)

Moshe S. Livšic—Leonid L. Waksman, Commuting Nonselfadjoint Operators in Hilbert Space (Lecture Notes in Mathematics, 1272), 114 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

The text consists of two independent parts. The first one is written by Livšic, and the second one by Waksman. The first part investigates operator colligations and collective motions of open systems. It turns out that a deep connection between the theory of commuting nonselfadjoint operators and the problem of wave equations can be found. The second part deals with harmonic analysis of multi-parameter semigroups of contractions. Firstly the strongly continuous isometric representations of multi-parameter semigroups $K \subset R^n$ in Hilbert space are considered, and then multi-parameter semigroups of contractions admitting dilations are investigated. In the Appendix triangular models of pairs of commuting operators are given.

László Gehér (Szeged)

Mathematical Ecology. An Introduction, Edited by Thomas G. Hallam and Simon A. Levin (Biomathematics, 17), XII+457 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1986.

"The study of ecology has its roots in the basic investigations of naturalists, who seek to understand the ecological and evolutionary relationships among species and their relationships to their environment. These studies usually have been retrospective, aimed at understanding how the universe we observe came to be. To explain why we see what we see, we must imbed our studies in a broader context, encompassing both what is and what is not. We must abstract and imagine, and construct a feasible world much bigger than reality; only then can we explain why evolution has taken the course it has ... Studies of this sort have been the mainstays of theoretical ecology, and occupy a major portion of this book."

These lecture notes reflect a nucleus of the material from the lectures presented during the first weeks of the Autumn Course on Mathematical Ecology, held at the International Centre for Theoretical Physics, Miramare—Trieste, Italy, November—December 1982.

First of all the ecological and mathematical foundations of the areas of physiological, population, community and ecosystem ecology are introduced in detail in this book. Moreover, some past and current problems are presented in the important fundamental topics. Speculations on possible directions for future research are also contained. Not only the theoretical aspects are explained but also some applied fields are developed.

The book is divided into five parts. Part I contains an overview on ecology by L. J. Gross. Two introductory papers by L. J. Gross on physiological and behavioral ecology are given in Part II. Papers in Part III (by T. G. Hallam, R. M. Nisbet, W. S. C. Gurney, J. C. Frauenthal, S. S. Levin and L. M. Ricciardi) are concerned with the dynamical and stochastic approach to population ecology. Part IV is devoted to the theory of communities and ecosystems. Here the authors are: T. G. Hallam, A. Hastings, S. A. Levin, M. Turelly and R. R. Lassiter. Two topics (resource management and infectious diseases, epidemiology) from applied mathematical ecology are developed and discussed by J. M. Conrad and R. M. May in Part V.

These very well written lecture notes will certainly be interesting and useful for both researchers in these areas and those interested readers wanting to understand the foundations and the basic problems of mathematical ecology.

T. Krisztin (Szeged)

Vladimir A. Marchenko, Sturm—Liouville Operators and Applications (Operator Theory: Advances and Applications Vol. 22), XI+367 pages, Birkhauser Verlag, Basel—Boston—Stuttgart, 1986.

In the various branches of mathematics there exist ever-living problems, inexhaustible sources (see for example the various problems of prime numbers, the solution of equations etc.). In the theory of differential equations such an eternal question is the now so called Sturm—Liouville equation: $y''+q(x)y=zy$ and the allied Sturm—Liouville operator $L=-d^2/dx^2+q(x)$. The first results concerning this equation go back to D. Bernoulli and L. Euler. Since then this equation has been constantly presented in the literature. In the middle of this century the transformation operators appeared in the theory of the Sturm—Liouville equation. As the results of e.g. A. Ya. Povzner, I. M. Gelfand, B. M. Levitan, B. Ya. Levin and V. A. Marchenko show, this tool became more and more important. In the Preface the author says: "The main goal of this monograph is to show what can be achieved with the aid of transformation operators in spectral theory, as well as in its recently revealed untraditional applications." The chapter headings are: The Sturm—Liouville equation and transformation operators; The Sturm—Liouville boundary value problem on the half line; The boundary value problem of scattering theory; Nonlinear equations.

Unfortunately sometimes it happens that mathematicians in the West or mathematicians in the East don't know the results of each other (e.g. language difficulties occur etc.). This book contains such questions in the theme in which the major part of the theorems belong to Soviet mathematicians. Often the original publications are not easily accessible. Perhaps this book helps to solve a part of these problems.

At last I'd like to mention the interesting examples and their hints which in some sense remind the reviewer of the examples being in the world famous book of Pólya and Szegő.

Lajos Pintér (Szeged)

J. M. Montesinos, Classical Tessalations and Three-Manifolds (Universitext), XIII+230 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

This book is devoted to a self-contained study of the interaction between the classical geometry of tessalations in euclidean and non-euclidean spaces and the topology of 3-manifolds. The origin of this relationship is the construction of a non-classical homological 3-sphere given by H. Poincaré in addition to the formulation of his famous conjecture in 1904 about the identity of homological and geometric spheres in higher dimensions. The homological 3-sphere can be interpreted as the manifold of positions of a dodecahedron inscribed in a 2-sphere. Similarly, the configuration spaces of platonic solids give interesting examples of other 3-manifolds. As the author says: "This is the type of topic we deal with in this book, only that instead of restricting our attention to the dodecahedron, we also consider the remaining platonic solids, and the euclidean and hyperbolic tessalations for which analogous constructions of three-manifolds can be developed in a similar way. At this stage one might also ask what can be considered new here. In fact, there is nothing new except the point of view. What I had in mind in writing this book was to use these constructions as a "pretext" for talking about three-manifolds and teaching geometrical intuition, which is crucial in forming our students to be able to make new discoveries in mathematics."

Really, the original and new view-point and entertaining style of this very nice book with numerous exercises, problems and illustrations yield a very good introduction to the intuitive geometry and topology. It can be highly recommended to graduate students and researchers interested in these fields.

Péter T. Nagy (Szeged)

V. V. Nikulin—I. R. Shafarevich, Geometries and Groups (Universitext), VI+251 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

The expression "geometrical" is used everywhere in both the theoretical and applied sciences without a well-defined sense. It means something visuable thing having analogue with the structure of the physical space. But different models of physical space are formulated using various mathematical notions: classical axiom systems of elementary geometry, discrete and continuous transformation group theory, classical differential geometry, manifold theory, surface topology etc. This excellent book, which is a translation of the Russian edition (Nauka, Moscow, 1983), gives an elementary introduction into intuitive geometry, based on a unification of the above approaches from the view-point of modern mathematics.

In Chapter I the authors formulate the main problems and illustrate them by the Euclidean description of the geometry on the sphere, cylinder and torus. Chapter II contains the classification of 2-dimensional locally Euclidean geometries: the plane, cylinder, torus, twisted cylinder and Klein bottle. The proof uses the description of uniformly discontinuous motion groups on the plane and an elementary introduction into the covering space construction. Chapter III is devoted to the space geometry and the crystallographic group theory. In the final Chapter IV there is given a treatment of lattice geometry and an introduction into Bolyai—Lobachevsky geometry using complex numbers and some modular group theory.

The book contains many exercises, hystorical remarks, very good illustrative figures and references for further study. Only familiarity with the knowledge of school mathematics is supposed. Certainly this book is very interesting and useful for mathematicians (both students and teachers) and non-mathematicians interested in the development of the sciences.

Péter T. Nagy (Szeged)

D. H. Pitt—A. Poigné—D. E. Rydeheard, Category Theory and Computer Science (LNCS, 283), V+300 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1987.

This volume is the proceedings of the Conference on Category Theory and Computer Science held in Edingburgh, September 7—9, 1987. Most papers reflect the fact that logical aspects of category theory have become the main issue in category theory applied to computer science.

Contributions are: G. Rosolini: Categories and Effective Computations; A. M. Pitts: Polymorphism is Set Theoretic, Constructively; Th. Coquand, Th. Ehrhard: An Equational Presentation of Higher Order Logic; S. Kasangian, A. Labella, A. Pettorossi: Enriched Categories for Local and Interaction Calculi; D. B. Benson: The Category of Milner Processes is Exact; G. Winskel: Relating Two Models of Hardware; D. E. Rydeheard, J. G. Stell: Foundations of Equational Deduction: A Categorical Treatment of Equational Proofs and Unification Algorithms; T. Hagino: A Typed Lambda Calculus with Categorical Type Constructors; L. S. Moss, J. Meseguer, J. A. Goguen: Final Algebras, Cosemicomputable Algebras, and Degrees of Unsolvability; G. Bernot: Good Functors ... are Those Preserving Philosophy; C. Beierle, A. Voss: Viewing Implementations as an Institution; S. Martini: An Interval Model for Second-Order Lambda Calculus; E. Robinson: Logical Aspects of Denotational Semantics; M. Proietti: Connections Between Partial Maps Categories and Tripos Theory; S. Vickers: A Fixpoint Construction of the p-adic Domain; J. M. McDill, A. C. Melton, G. E. Strecker: A Category of Galois Connections.

The volume will be useful to specialists interested in category theory or categorical aspects of computer science.

Z. Ésik (Szeged)

W. Purkert—H. J. Ilgauds, Georg Cantor (Vita Mathematica 1), 262 pages, Birkhäuser Verlag, Basel—Boston—Stuttgart, 1987.

This new series "Vita Mathematica" of the Birkhäuser Verlag is in some sense a continuation of the 16 "supplements" to the journal Elemente the Mathematik published by the Birkhäuser Verlag between 1947 and 1980. The difference from the supplement is not only formal (considerably greater length in book form). The aim of the new series is to present technical biographies of great mathematicians from antiquity to modern times, taking into account relevant research carried out in recent decades. In the forthcoming volumes we will read on Pascal, Dirichlet, Felix Klein and Euler among others.

The last (the sixth) part of Cantor's fundamental work "Über unendliche lineare Punktmannichfaltigkeiten" appeared in the Mathematischen Annalen about 100 years ago. This was the birth of Set Theory with an essentially new approach to the infinity in mathematics which was embodied in the theory of transfinite numbers. D. Hilbert described it as "the most marvellous flower of the mathematical spirit and really one of the highest achievements, pure reasonable human activity".

In the two first (and short) chapters of the book (written in German) we can read on Cantor's childhood and his studies in Zürich, Göttingen and Berlin. The third and main chapter is the "Genesis der Mengenlehre" (The Genesis of Set Theory). In the subsequent chapters we can read on Cantor's illness, on his personality and philosophy, on the antinomies and his final years.

A subsequent chapter deals with researches due to Zermelo, Hilbert and others which were striven to avoid the antinomies.

The book ends with numerous documents (letters to and from Cantor), a chronology and a detailed bibliography.

Finally, we cite the last paragraph of the Editorial of the book: "May the series Vita Mathematica help to promote interest in the history of science in our time when consciousness of history is deficient and decline in the use of language is evident. Thereby we may contribute in a small way to our culture."

We hope that the forthcoming volumes of this series will serve this aim as good as the first excellent one.

Lajos Klukovits (Szeged)

H. Riesel, Prime Numbers and Computer Methods for Factorization (Progress in Mathematics, 57) XVI+464 pages, Birkhäuser, Boston—Basel—Stuttgart, 1987 (revised and corrected second printing).

Applications of number theory have growing interest nowdays. It can be used in several areas of science and engineering, e.g., in communications, coding theory and cryptology.

In number theory there are several easily formulated problems, solutions of which are rather advanced. The author's aim is to write a book on this topic suitable for mathematically inclined layman, as well as for a more advanced student. For this reason not all results are proved, but there are detailed bibliographical references to serve the readers interested in the proofs. There are references to recent original works as well.

The main text has six essentially independent chapters. The Number of Primes Below a Given Limit; The Primes Viewed at Large; Subleties in the Distribution of Primes; The Recognition of Primes; Factorization, Prime Numbers and Cryptography.

While number theory is a small part of the basic mathematical courses only, the book has six additional chapters (appendices) which contain all the algebra and number theory (basic concepts in higher algebra and arithmetic, quadratic residues, arithmetic of quadratic fields, continued fractions, algebraic fractions) required for the main text. There are another three appendices, two on computational questions (multiple-precision arithmetic, fast multiplication of large integers) and one on the Stieltjes integral.

For those readers who have accesses to computers, the author has provided computer programs written in the high-level programming language PASCAL for many of the methods (and algorithms) described in the text.

At the end of the book a large amount of results are collected in 34 tables, e.g., primes below 12 553 and between 10^n and 10^n+1000 ($n=5, 6, \ldots, 15$), factors of Fermat numbers and of Mersenne numbers, factors of integers of types a^n+b^n for some small a and b, quadratic residues.

This carefully written and excellently printed book will be enjoyed by both mathematicians and non-mathematicians, everybody who are interested in number theory and its applications.

Lajos Klukovits (Szeged)

K. P. Rybakowski, The Homotopy Index and Partial Differential Equations (Universitext), IX+208 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

This book grew out of lectures held by the author at various universities. Recently the homotopy index theory has become a useful tool in perturbation problems involving ordinary differential equations. The homotopy index generalizes the Morse index, it was developed by Ch. Conley for twosided flows on compact spaces. It was a natural thing to try the application of the theory for partial differential equations as well. But this problem requires further extension of the homotopy index theory. This was done by the author who published it previously in several papers. This book

is a clear presentation of the results written not only for experienced researchers but for readers having only modest knowledge of algebraic topology.

The book consists of three chapters. In Chapter 1 the author presents the main concepts of the categorial Morse index and the homotopy index. This chapter is especially useful for beginners in this field. Several examples make the introduced notions more understandable. In Chapter 2 applications are given on parabolic partial differential equations and on functional differential equations. The third, relatively brief, chapter contains selected topics.

This is an interesting book on the application of a modern notion promising further new results.

Lajos Pintér (Szeged)

Masahiro Shiota, Nash Manifolds (Lecture Notes in Mathematics, 1269), VI+223 pages, Springer-Verlag, Berlin—Heidelberg—New York—London, 1987.

The purpose of this book is to construct a theory of real manifolds equipped with "algebraic" structures. The fundamental ideas are the following:

A semialgebraic subset of R^n is by definition a finite union of sets of the form

$$\{x \in ER^n : f_1(x) = \ldots = f_k(x) = 0,\ g_1(x) > 0, \ldots, g_k(x) > 0\},$$

where $f_1, \ldots, f_k, g_k$ are polynomials. (For example a compact polyhedron in R^n.) A C^r map between two semialgebraic subset of R^n and R^m is C^r Nash-map if its graph is semialgebraic in $R^n \times R^m$. A C^r manifold with a finite system of coordinate neighbourhoods $\{\psi_i : U_i \to R^m\}$ is a C^r Nash-manifold of dimension m if for each i and j, $\psi_i(U_i \cap U_j)$ is an open semialgebraic subset of R^m and the map $\psi_j \circ \psi_i^{-1}$ is a C^r Nash-diffeomorphism.

The main result of this subject has been proved by Nash. Namely he showed that a compact C^1 manifold M can be imbedded in a Euclidean space R^n and such a C^ω Nash-manifold structure on M is unique up to C^ω Nash-diffeomorphism. Hence we can endow a compact C^1 manifold with "algebraic" properties, which appears to contribute to differential topology. Really, there are several applications of this result.

This book is clearly and accurately written. Certainly it will be interesting for researchers working in differential topology, *PL* topology or Nash-manifold.

Árpád Kurusa (Szeged)

Trends, Techniques, and Problems in Theoretical Computer Science (Selected Contributions, Smolenice, Czechoslovakia, 1986), Edited by A. Kelemenová and J. Kelemen (Lecture Notes in Computer Science, 281), VI+213 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1987.

This volume contains a selected collection of papers presented at the scientific programme of the Fourth International Meeting of Young Computer Scientists (IMYCS 86) held at Smolenice Castle Czechoslovakia, October 13—17, 1986.

"Organized biennially since 1980, the meetings are intended to stimulate the scientific activity of beginners in computer science, mainly that of both university students in the final years of their studies and of graduates. Therefore, the scientific programme of the meetings include tutorials and more invited lectures than it is usual at conferences."

In this book the texts of the tutorial of IMYCS 86 as well as the texts of all invited talks are included together with some selected short communications presented during the meeting's regular and informal evening sessions. Thematically, the volume is divided into four chapters:

Chapter 1. VLSI and Formal Languages: J. Hromkovič: Lower bound techniques for VLSI algorithms; J. Karhumäki: The equivalence of mappings on languages; J. Sakarovitch: Kleene's theorem revisited; Z. Tuza: Some combinatorial problems concerning finite languages.

Chapter 2. Theory of Formal Grammars: E. Csuhaj—Varjú: A connection between descriptional complexity of context-free grammars and grammar form theory; H. C. M. Kleijn: Basic ideas of selective substitution grammars; G. Păun: Some recent restrictions in the derivation of context-free grammars.

Chapter 3. Biologically Motivated Structures: V. Aladyev: Recent results on the theory of homogeneous structures; M. Král'ová: A note on the ratio function in DOL systems; A. Lindenmayer: Models for multicellular development: Characterization, inference and complexity of L-systems.

Chapter 4. Artificial Intelligence: J. Kalaš: A formal model of knowledge-based systems; F. N. Springsteel: Basic complexity analysis of hypothesis formation; P. Szeredi: Perspectives of logic programming.

We warmly recommend this interesting volume to everybody who works in Theoretical Computer Science.

S. Vágvölgyi (Szeged)

W. Van Assche, Asymptotics for Orthogonal Polynomials (Lecture Notes in Mathematics, 1265), VI+201 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

Recently there has been a great deal of interest in the theory of orthogonal polynomials. The number of books dealing with the subject, however, is limited. This monograph contains some results on the asymptotic behaviour of orthogonal polynomials when the degree tends to infinity. Only a basic knowledge of real and complex analysis is assumed. In Chapter 1 the asymptotic behaviour of orthogonal polynomials on a compact set is discussed. Results are given for orthogonal polynomials on the interval $[-1, 1]$ especially those belonging to the Szegő class. In Chapter 2 among others recurrence relations are given for the orthogonal polynomials in the case when the recurrence coefficients are asymptotically periodic. In Chapter 3 a new method based on well-known theorems of probability theory is given to obtain asymptotic formulas for sequences of polynomials. Chapter 4 is devoted to study the orthogonal polynomials on infinite intervals. The results involve the zero distribution for orthogonal polynomials with exponential weights (asymptotic results for the largest zeros, for the leading coefficient are given). Chapter 5 deals with some consequences of the existence of the asymptotic zero distribution. In the final Chapter 6 some applications of the theory given in the previous chapters can be found.

The book is warmly recommended to both researchers and graduate students interested in approximation theory, orthogonal polynomials and mathematical physics.

József Németh (Szeged)

Joachim Weidmann, Spectral Theory of Ordinary Differential Operators (Lecture Notes in Mathematics, 1258), VI+303 pages, Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo, 1987.

This volume presents a general and rather complete spectral theory for selfadjoint ordinary differential operators with motivations and some applications in physics. The generating differential expressions are of order n, operate on $\mathbf{C}^m$-valued functions ($n, m \in \mathbf{N}$), and are sufficiently general in order to cover the "classical" cases.

The selfadjoint realizations in certain L^2 spaces of the considered differential expressions are based essentially on the notion of quasi derivatives and a quite general existence and uniqueness theorem for first order systems. The discussion of the induced selfadjoint operators starts with the determination of the maximal and (closed) minimal ones (denoted by T and T_0, respectively). Then the deficiency indices and the selfadjoint extensions of T_0 are studied, mainly by means of the boundary conditions of the solutions of $(\tau-\lambda)u=0$ (τ is the generating differential expression). For these extensions a spectral theory is developed: the general forms of the resolvent, the spectral representation and the spectral resolution are studied, the spectral multiplicity and the absolute continuous spectrum is discussed. Attention is paid to differential operators with periodic coefficients. An oscillation theory is developed for Sturm—Liouville operators and Dirac systems, and this is applied in studying their spectral properties. Finally explicite solutions are given for some problems concerned with special cases of Sturm—Liouville operators and Dirac systems.

Mathematicians or physicists, postgraduate students and researchers will certainly find the generality of the treatise as well as the many-sided discussion to be of interest. The book contains also new results; its method is functional analytic whenever possible. The reader has to be familiar with basic facts of analysis and needs some knowledge of the abstract theory of selfadjoint operators.

E. Durszt (Szeged)

Marisa Venturi Zilli, Mathematical Models for the Semantics of Parallelism (Lecture Notes in Computer Science, 280), IV+231 pages, Springer-Verlag, Berlin—Heidelberg—New York, 1987.

The volume contains eight papers from the material presented at the Advanced School on Mathematical Models for the Semantics of Parallelism, Rome, September 24—October 1, 1986. The papers discuss diverse approaches to concurrent systems.

Table of contents:

L. Aceto, R. De Nicola and A. Fantechi: Testing equivalences for event structures, p. 1—20. Three extensional models of concurrency are defined in the common framework of event structures. These models correspond to different kinds of observations: sequences of actions, sequences of multisets of actions, and partial orderings of actions. Some basic relationships are established.

P. America and J. de Bakker: Designing equivalent semantic models for process creation, p. 21—80. This long paper provides a detailed analysis of certain models for concurrent languages with process creation. The languages fall into four categories according to their uniform/nonuniform and static/dynamic nature. The models are defined in metric structures involving either linear or branching time semantics.

E. Astesiano and G. Reggio: An outline of the SMoLCS approach, p. 81—113. The paper elaborates a methodology for the specification of concurrent systems and languages. The methodology has both algebraic and denotational flavour.

M. Broy and T. Streicher: Views of distributed systems, p. 114—143. This is a rather informal paper on the various issues on distributed systems, focusing around the notion of a process, sequentiality, functionality, and some aspects of semantics.

P. Degano, R. De Nicola and U. Montanari, CCS is an (augmented) contact free C/E system, p. 144—165. It is shown how Milner's CCS can be modeled by a class of Petri nets in a way which corresponds to the original interleaving semantics.

J.-Y. Girard: Linear logic and parallelism, p. 166—182. An informal paper on the relevance of a kind of intuitionistic logic to concurrent computations.

A. Labella and A. Pettorossi: Universal models in categories for process synchronization, p. 183—198. Processes are defined as objects of a category with morphisms labelled by the elements

of a free monoid. The notion of synchronization is then captured by that of a functor. The category of (synchronization) trees is related to behaviours of processes.

G. Mirkowska and A. Salwicki: On axiomatic definition of Max-model of concurrency, p. 199—230. The admissible parallel executions of a concurrent program are shown to provide an optimal Kripke model of a set of model formulas determined by the program itself.

The volume can be recommended to graduate students and researchers with interest in concurrency.

Z. Ésik (Szeged)